

# Paratrooper Ankle Injury Intervention and Evaluation:

The Challenge of Injury Control in the Army

**Armed Forces Epidemiology  
Board**

**DEC 6, 2005**

**COL Paul J. Amoroso, MD, MPH**

Military Performance Division

US Army Research Institute of Environmental  
Medicine

Natick, Massachusetts



# Overview of Tactical Parachuting























# The basic plot

- Problem identification- high injury rates among Army Parachutists
- Preliminary scientific investigations
- The intervention; the parachute ankle brace (PAB)
- Randomized intervention trial
- Additional studies add to scientific evidence
- The intervention is fielded
- Eventual discontinuance of brace based on cost, fear, and anecdote
- Additional scientific evidence- evaluation study
- Back to the beginning?

# Problem Identification

- ~1991 Airborne community makes request for assistance to USARIEM
- Early investigations show that injuries usually occur on landing and most are to the lower extremities

# Airborne School, 1991\*

- 447/554 (81%) of one class of Airborne students volunteered for participation
  - 29/447 seen in TMC or ER for injury (6.5%)
    - 20/29 had lower extremity injuries (69%)
    - 8/29 had trunk, back, or head injuries (27.6%)
    - 1/29 had an upper extremity injury (3.4%)

# Army Safety Center Data

- Activity code = tactical parachuting
- Excellent qualitative data on injury
- Thousands of jump injuries recorded

# Parachute Injuries Reported to the Army Safety Center\*

Body Part	Men (n=4170)	Women (n=146)
Head and Neck	14.0%	12.3%
Trunk/Chest	4.7%	2.7%
Back	14.6%	9.6%
Upper extremity	10.0%	2.7%
Leg/knee	21.2%	20.5%
Ankle/Foot	34.1%	50.0%
Other/unknown	1.4%	1.1%

\***Safety Center Data, 1985-1994.** Amoroso PJ, Bell NS, Jones BH. Injury among female and male army parachutists. *Aviation Space and Environmental Medicine* 1997;68(11):1006-11

# Cause of parachute injury\*

	Men	Women
Aircraft Exit	11%	4%
Malfunction	<1%	2%
Interference	6%	4%
Canopy Control	7%	0%
Landing hazard	20%	8%
PLF	50%	72%
After landing	1%	4%
Other/unknown	4%	6%

\*Derived from **Safety Center Narrative Data, 1985-1994**. Amoroso PJ, Bell NS, Jones BH. Injury among female and male army parachutists. *Aviation Space and Environmental Medicine* 1997;68(11):1006-11

# Development of Intervention

- Success of ankle bracing previously demonstrated among West Point athletes
- Parachute Ankle Brace (PAB)
  - Fits over the boot
  - Easily put on
  - Full ambulation
  - \$60/pair
  - Reasonably comfortable



# Randomized Intervention Trial

- Study designed and planned for 82<sup>nd</sup> Airborne (Ft. Bragg)
  - 82<sup>nd</sup> deploys for Hurricane Andrew 2 days before study start date
  - Airborne School provides alternative study population

# Randomized Trial

- 4 consecutive classes of Airborne students participated
  - 777 volunteers
  - 3,674 jumps
  - 1 pre- and 5 post jump surveys
  - Full medical records review and all injured soldiers examined by an orthopedic surgeon

# Ft. Benning PAB study- 1993\*

- **With PAB:                    n = 369 (1825 jumps)**
  - **5 ankle injuries, 1 inversion sprains**
- **Without PAB:        n = 376 (1849 jumps)**
  - **10 ankle injuries, 7 inversion sprains**
- **Rate of ankle sprains:**
  - **0.55/1000 braced**
  - **3.79/1000 unbraced.**
- **Rate Ratio 7:1, p=0.04**

# Additional Studies

- Ft. Bragg 1994 (randomized trial, Amoroso, et al)
- 3/75<sup>th</sup> Rangers (38 month retrospective study)\*
- 1998-99 39 week prospective 75<sup>th</sup> Ranger Regiment (Creedon, et al)

\*Schumacher JT, Creedon JF, Pope RW. The effectiveness of the parachutist ankle brace in reducing ankle injuries in an airborne ranger battalion. Mil Med. 2000 Dec;165(12):944-8

# Fielding of Intervention

- Within weeks of study completion PAB is adopted by Airborne School
  - Expected cost avoidance → \$2.5 million *per year*
- Army type classifies PAB (it gets a stock number)
- 40,000 pairs purchased → \$1.9 million
- Braces also used by 82<sup>nd</sup> Airborne and Ranger Battalions but not *required*

# Discontinuation

- After 7 years, Airborne School decides to discontinue use in September of 2000
  - Costly
  - Injury rates are already low
  - Anecdotal concerns in airborne community that braces might contribute to proximal or other serious injury

# Anecdotal Concerns: Entanglements

- Dept. of Orthopedics, Ft Bragg
  - Reported repair of multiple “blown” knees related to entanglements of feet in risers; some report PAB use
- 2/75<sup>th</sup> Rangers
  - PAB caught in risers leading to ACL tear
- 3/75<sup>th</sup> Rangers-
  - Foot and PAB caught in anti-inversion net of another jumper (no adverse outcome)

# Scientific data as well as cost-benefit analyses needed

- Sprains and most fractures, while duty limiting, usually result in full recovery
- Entanglements are rare but potentially catastrophic

# Additional Research?

- Randomized Trial-- impractical for rare events
- Prospective studies-- costly, technically challenging, and time consuming
- Retrospective study-- possible

# Total Army Injury and Health Outcomes Database

- Link student rosters from Airborne School with electronic hospitalization records
  - 220,000 soldiers completed training between 1985 and 2002
  - Over one million parachute descents
- Virtually all hospitalizations recorded at Ft. Benning Hospital

# An Evaluation Study of the Parachute Ankle Brace,

**Army Airborne School, 1985 - 2002**

127k students

68k students

28k students

**Pre Brace**

**Brace  
Wear**

**Post  
Brace**

**Paper Rosters**

**Electronic  
Rosters**

Oct 1995

**Randomized  
Trial Oct 1993**

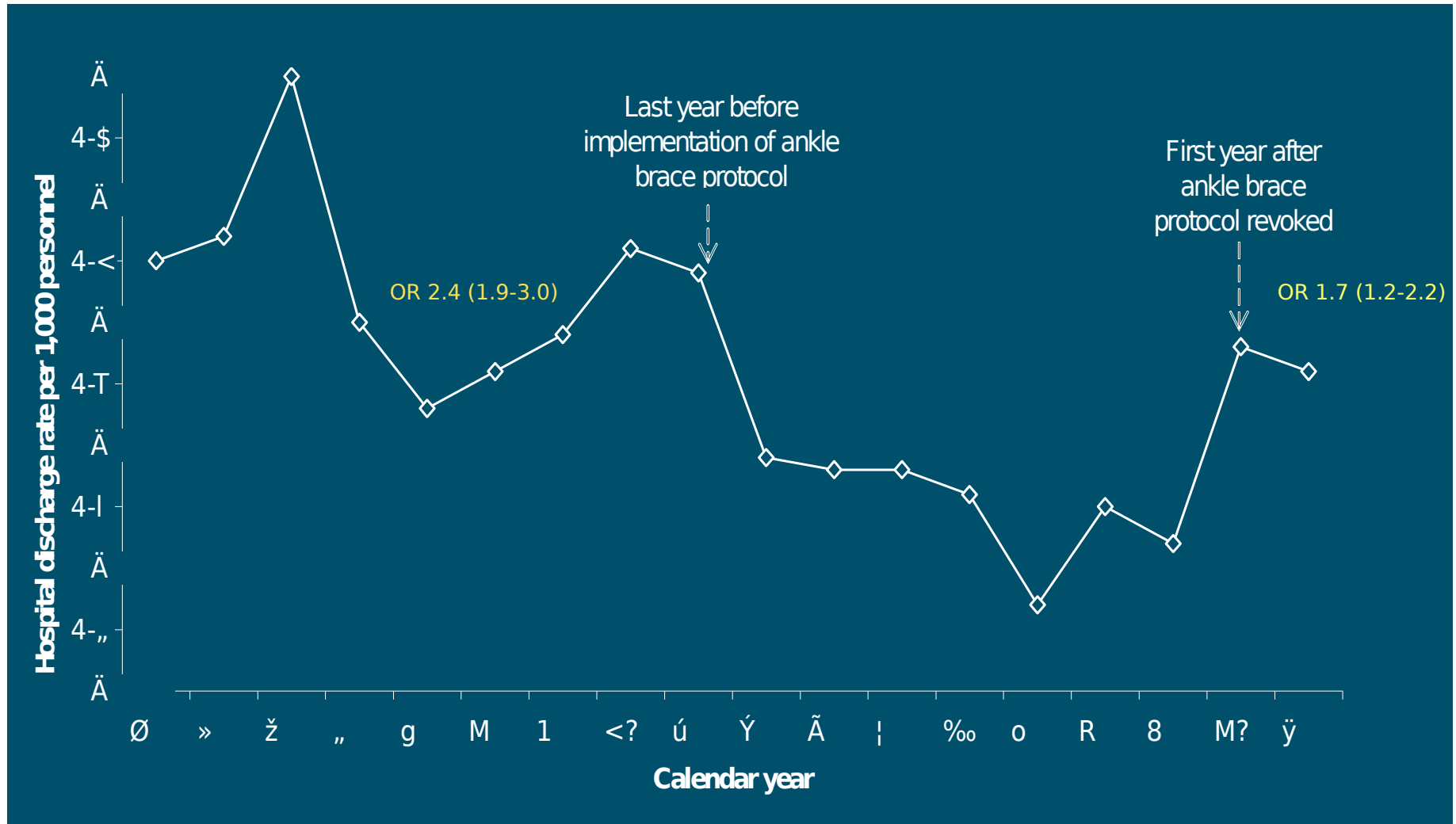
Jan  
1985

Jan  
1994

Oct  
2000

Dec  
2002

# Annualized ankle injury hospitalization rates for PAB cohort, 1985-2002.



# End of story?

- Braces re-introduced in July 2005
- Additional evaluation studies underway at ARIEM (also extend to outpatient data)
- Ft. Benning conducting their own survey
- Extension to the rest of Airborne community is anticipated
- Effort funded and very closely watched by the Defense Safety Oversight Council

